Rare earth element geochemistry of Kieslager-type massive sulfide deposits in southwestern Japan

K. HATSUYA[1] AND K. KOMURO[2]

[1] Master's Program in Science and Engineering, University of Tsukuba, 1-1 Ten'nodai Tsukuba Ibaraki 305-8571, Japan hatsuya@luna.riko.tsukuba.ac.jp

[2] Institute of Geoscience, University of Tsukuba, 1-1 Ten'nodai Tsukuba Ibaraki 305-8571, Japan, komuro@arsia.geo.tsukuba.ac.jp

Many Kieslager-type massive sulfide deposits (commonly called as Besshi-type in Japan) are known to be hosted in the accretionary complexes in southwestern Japan. Most of them occur in the Sambagawa metamorphic belt, but some are also found in other weakly or non-metamorphosed accretionary terrains. In order to understand the formative processes and environment of the deposits, chemical analysis especcially of the rare earth elements (REE) are carried out for the ores from about 40 localities in different terrains by the inductively coupled plasma atomic emission spectrometry (ICP-AES) and the inductively coupled plasma mass specrometry (ICP-MS).

The ores used in this study are classified into 3 types: high-grade ores, low-grade ores and disseminated ores, on the basis of the sulfides contents. The chemistry of the ores are closely related with the ore types. The high-grade ores are enriched mainly in the chalcophile elements such as Cu, Fe, Cd, Ag, Bi, Zn, In, Te, Co, Mo, Pb, As, Tl and Sb, and depleted in the lithophile elements such as Na, Rb, Ba, Al, REE, Th, Y, Cs, Sc, Ti, Li, W, Be, Mg, K, V and Ca, compared with the other types. The disseminated ores are depleted in the chalcophile elements and enriched in the lithophile elements.

The chondrite-normalized REE patterns of the ores are various, but are also intimately related with the ore types. The high-grade ores have lower REE contents with weak negative Ce anormaly and distinct positive Eu anormaly. The low-grade ores have medium REE contents and variety of Ce anormaly and Eu anormaly. The desseminated ores have higher REE contents with no Ce anormaly and negative Eu anormaly. These variation is considered to be due to the amounts of the lithogenous component having higher REE contents with negative Eu anormaly, and of the sulfide component of lower REE contents with negative Ce anormaly and positive Eu anormaly. The REE pattern of sulfide component is quite similar to that of modern hydrothermal ore deposits.

On the basis of the results, the formative processes and environment of the Kieslager–type massive sulfide deposits will be discussed.

Water circulation in Japan Sea: Using dissolved rare earth elements as the tracers

M. HATTA[1] AND J. ZHANG[2]

[1]Toyama university, Japan (d033026@hotmail.com)

[2]Toyama university, Japan (jzhang@sci.toyama-u.ac.jp)

Since the timescale of the abyssal circulation has been estimated as about 100-300 years, the Japan Sea can be regarded as a miniature version of the global ocean. Although the Japan Sea has its own deep convection system (thermohaline conveyer belt), reported to start in the northern part of the Russian shelves or offshore of Vladivostok in winter, it is still uncertain precisely where water sinks toward the sea floor. Recently, weakened subduction of seawater has been reported as a result of global warming. However, this was found in the area offshore of Valdivostok in April 2001 (Senjyu et al., 2002), not in the northern part. Thus, in this study, the dissolved oxygen and the rare earth element concentration were measured to clarify the behavior of the new bottom water (NBW) and the effect on the center Japan Basin, which is an influential tracer of the water mass transfer and a clue to the minute fluctuation.

Seawater samples were collected at three stations during the KT01-15 expedition of the R/V Tansei Maru in 2001 and at four stations during the KH98-3 expedition of the R/V Hakuho Maru in 1998 (Ocean Research Institute of University of Tokyo, Japan). Higher dissolved oxygen (DO) concentrations were observed in the bottom water in 2001 than in 1998. Generally, the DO is consumed only in the deep water, while none is supplied by new subduction. On the other hand, recent research (Watanabe, 2002) has reported that the DO changes in the bottom water, which called inter-decadal oscillation (IDO). Although the NBW formed in winter (January-February, 2001) with high DO concentration, it is still difficult to use DO as a tracer for water mass variation in the Eastern Japan Basin, due to the influence of the IDO of the Japan Sea. Rare earth elements (REEs) generally exhibit low concentrations in surface seawater and then increase with water depth. Our results of measuring REE concentrations in the bottom water, at depths deeper than 2700 m, were lower than in the upper water of the Eastern Japan Basin. Together with their flatter shallow-normalized REE Patterns, the results suggest that the shallow water flows into the bottom water mass of the Eastern Japan Basin. If we suppose that this shallow water was NBW that sank off Vladivostok, the calculated flow velocity would be at least about 2 to 2.6 cm/sec by using the time difference of two observations and straight transport distance. Such an estimate would closely agree with the flow rate previously published for the Japan Sea. In summary, NBW from the Vladivostok area was found in the Eastern Japan Basin by observation of dissolved oxygen and REEs; this implies that REEs, in particular, could be extremely useful as tracers of detailed short-term ocean circulation.